pressure since 1888 was recorded at San José (668.3 mm.) and the same day was also the coldest in fourteen years of observations, the mean temperature of the twenty-four hours being 14.23° C. On the Atlantic slope rainy days prevailed all through the month, with several storms, the exact dates of which could not be obtained.

Earthquakes.—December 27, 10h a. m., tremors. December 30, 10h 10m p. m., slight tremors.

CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of Mr. Maxwell Hall, the following data are offered to the MONTHLY WEATHER REVIEW in advance of the publication of the regular monthly weather report for Jamaica:

Comparative table of rainfall for December, 1901.
(Based upon the average stations only)

Divisions.	Relative area.	Number of stations.	Rainfall.	
			Average.	1901.
			Inches.	*Inches.*
Northeastern division	25	21	9.45	8.38
Northern and subcentral division	22	54	5.60	6.17
Western-central division	26	24	3.91	4.30
Southern division	27	32	2.66	2.62
General means	100	131	5.40	5.37

In taking the average rainfall Mr. Hall uses only those stations for which he has several years of observation, so that the column of averages represents fairly well the normal rainfall for each division, while the column for the current month represents the average rainfall at those same stations. The relative areas of the divisions are very nearly the same and are given in the preceding table as expressed in percentages of the total area of Jamaica. The number of rainfall stations utilized in each area varies slightly from month to month, according as returns have come in promptly or not, but will not differ greatly from the numbers in the second column of the table.

Jamaica, W. I., climatological data, December, 1901.

	Negril Point Lighthouse.	Morant Point Lighthouse.
Latitude (north)	18° 15′	17° 55′
Longitude (west)	78° 22′	76° 10′
Elevation (feet)	33	8
Mean barometer 7 a. m.	29.936	29.925
Mean barometer 3 p. m.	29.878	29.880
Mean temperature 7 a. m	75.0	78.6
Mean temperature 3 p. m	82.1	83.1
Mean of maxima	85.3	.....
Mean of minima	72.7	.....
Highest maximum	89.0	.....
Lowest minimum	68.0	.....
Mean dew-point 7 a. m	69.9	.....
Mean dew-point 3 p. m	71.5	.....
Mean relative humidity 7 a. m.	84.0	.....
Mean relative humidity 3 p. m.	71.0	.....
Total rainfall (inches)	0.78	7.88
Average wind direction 7 a. m	ne.	nne.
Average wind direction 3 p. m	nne.	nne.
Average hourly velocity, miles 7 a. m	8.8	12.2
Average hourly velocity, miles 3 p. m	12.3	14.2
Average cloudiness (tenths):		
7 a. m. Lower clouds	2.1	1.6
7 a. m. Middle clouds	1.7	1.8
7 a. m. Upper clouds	1.7	1.0
3 p. m. Lower clouds	0.6	2.1
3 p. m. Middle clouds	5.0	2.0
3 p. m. Upper clouds	1.7	0.9

NOTE.—The pressures are reduced to standard temperature and gravity, to the Kew standard, and to mean sea level. The thermometers are exposed in Stevenson screens.

REPORT OF THE CHIEF OF THE WEATHER BUREAU FOR THE YEAR ENDING JUNE 30, 1901.[1]

Dated July 22, 1901.

OCEAN FORECASTS AND INTERNATIONAL COOPERATION.

An important extension of the forecast work of the Bureau was made during the year. By an arrangement with the secretary of the meteorological office at London, England, the transmission by cable from London to Washington of meteorological reports from certain points in the British Isles and on the Continent of Europe, and from Ponta Delgada, Azores, was begun December 18, 1900. These reports, with observations from Nassau, Bermuda, and Turks Island, have been regularly published on the daily weather maps issued at Washington, Baltimore, Philadelphia, New York, and Boston, together with forecasts of the force and direction of the wind and the state of the weather for the first three days out of steamers bound east from American ports.

The Atlantic forecasts, which are based on the American, Atlantic, and European telegraphic reports, were begun January 7, 1901, and on June 1, 1901, they were made a part of the regular general night forecasts issued at Washington. In a number of instances, when storms of marked strength were passing eastward off the American coast, forecasts were issued of the character of the weather which would probably be experienced by steamers leaving European ports westward bound, and by an arrangement with Lloyd's, of London, these advices have been cabled to England.

In addition to the daily forecasts of wind and weather and special storm warnings, predictions of fog were issued when conditions favorable for fog development had been indicated in the steamer tracks west of the fiftieth meridian. Reports from transatlantic steamships show that these forecasts and special warnings have been well verified.

In November, 1900, arrangements were made with Portugal to receive reports from the meteorological observatory at Horta, in the Azores. Observations are now regularly received by cable from that place, and they are of much value in the work of forecasting the movements of storms on the Atlantic Ocean.

NEW FORECAST DISTRICTS.

Three additional forecasting districts have been established and designated as the New England district, the West Gulf district, and the Rocky Mountain district, with headquarters at Boston, New Orleans, and Denver, respectively. The last appropriation bill passed by Congress made provision for three additional forecast officials to be placed in charge of these districts with authority to issue forecasts and warnings for the several States that are comprised in each district. This system has the advantage of enabling each forecaster to devote more time to the consideration of the predictions for each district and of securing an earlier distribution of forecasts. As these forecast officials were selected on account of their

[1] We reprint herewith the Annual Report of the Chief of the Weather Bureau to the Secretary of Agriculture, omitting only the sections devoted to the Galveston Hurricane, and Frost and Flood warnings, which are made up largely of matter that has already appeared in the REVIEW. This report contains much that is of interest to our many voluntary observers, and which they will probably not see elsewhere.

ability as forecasters for their respective sections, it is expected that an improved service will result.

IMPROVEMENT IN FORECASTS.

Special consideration has been given to the subject of increasing the accuracy of the forecasts of the Weather Bureau to the highest degree attainable, and, as a means of stimulating among the employees of the Bureau the study of the problems of weather forecasting, announcement has been made that hereafter marked success in forecasting, the invention of new methods of forecasting, or the discovery of new facts or principles of marked value to the forecaster, will have a special weight when the merits of employees, of whatever grade, for promotion are considered.

The forecasters of the central office at Washington have been relieved, as far as possible, of all other routine work, and they will devote their whole time and energies to forecast duty. These forecasters, when not detailed at the daily work of forecasting, will engage in studies that aid them in their work. It is believed that this arrangement will result in an improvement of the forecasting work of the service.

CLIMATE AND CROP WORK.

The lines of work pursued in previous years by the climate and crop service of the Weather Bureau were continued, and extensions and improvements made wherever possible. The cotton-region service has been extended into Oklahoma and the Indian Territory, and arrangements have been made for inaugurating a similar work in California, to be known as the fruit and wheat service.

Few persons realize what a complete system the Weather Bureau forms for the accurate and rapid collection and dissemination of crop information. It has 1,200 paid and skilfully trained officials outside of Washington, who are quite evenly distributed over the United States and its island possessions, and who are available to report on any matters concerning weather, crops, climate, or statistics. It has 200 officials and employees at the central office in Washington. It has 180 fully equipped meteorological stations quite equidistantly scattered over the United States and its dependencies, each manned by from one to ten trained officials, which stations are not only weather observatories, but are centers for the gathering of statistical and climate and crop reports. It has a central observatory in each State and Territory, to which all subordinate offices in the State report, and to which all voluntary weather and crop observers report. These central observatories are equipped with printers, printing plants, trained meteorologists and crop writers, clerks, and messengers.

The State central offices are under the systematic direction of the central office at Washington. The central office at Washington is equipped with cartographers, printers, pressmen, lithographers, and elaborate addressing and mailing appliances for the printing and mailing of large quantities of National weekly, monthly, quarterly, or annual reports and bulletins. The telegraph circuits of the Weather Bureau are ingeniously devised for the rapid collection, twice daily, of meteorological reports; they are also used to collect the weekly National crop bulletin. The Bureau has 315 paid temperature and rainfall reporters who are now daily telegraphing their data from the growing fields to certain cotton, corn, and wheat centers. It has 250 storm-warning displaymen distributed among the ports along the Atlantic, Gulf, and Pacific coasts and in the lake region. It has an observer serving each morning on the floor of each important board of trade, commercial association, or cotton or maritime exchange in the country, who displays weather and crop information, and each day charts the weather reports on a large map. It has 3,000 voluntary observers—nearly one for each county in the United States—equipped with standard thermometers, instrument shelters, and rain gages, who have for years intelligently served the Government by taking daily weather observations and rendering weekly crop reports to State central offices. There are 14,000 persons reporting weekly to the climate and crop centers as to the effect of weather upon the crops in their respective localities. These voluntary crop correspondents could quickly be increased in number to several hundred thousand if occasion required. In four weeks there are printed and distributed 168 different State crop bulletins, four National crop bulletins, and 42 monthly eight-page State climate and crop bulletins. The weekly State crop bulletins are written by the directors of the different State sections, and the weekly National crop bulletin by Mr. James Berry, chief of the climate and crop division of the Weather Bureau, a man who has had many years experience as a writer on crop conditions in the United States.

FORECASTS BY RURAL FREE DELIVERY.

Particular attention has been given to the distribution of forecasts by means of the rural free delivery. There are now in operation 365 centers supplying an aggregate of nearly 42,000 families in the farming districts with the latest weather predictions. This work has become decidedly popular, and we have had the hearty cooperation of the Post-Office Department in making it a success.

Estimate has been made for additional appropriation with which to extend the distribution of forecasts and warnings by this method. The rural free delivery places the frost and cold-wave warnings in the hands of those who can make the most valuable use of them. It is expected that the Bureau will reach several hundred thousand farmhouses with the daily forecast before the expiration of the coming year.

MOUNTAIN SNOW BULLETINS.

The local snow bulletins that are issued by the State centers in the Rocky Mountain region are meeting a very important need. These bulletins give complete information as to the depth and character of snowfall in the mountains—data that have such an important bearing on summer water supply for irrigation purposes.

ETHERIC SPACE TELEGRAPHY.

Substantial improvements have been made during the past year in the Weather Bureau system of wireless telegraphy. The line of research has been divided into three classes: First, the perfection of a more powerful transmitter, in which the energy of radiation shall be greatly increased; second, the devising of a more delicate receiver, one that would be positive instead of depending upon an imperfect and variable contact, as do all systems now in use; and, third, the perfection of a system of selective telegraphy, whereby messages can be differentiated, so that only the receiver for which the message is intended shall become responsive to the waves of ether.

The first of these problems may be said to have been successfully solved, and a transmitter devised capable of radiating all the energy generated; the second is believed to be nearing a successful solution; the third is thought to be well demonstrated theoretically, but has not been fully tested in practise.

While there is much experimental work yet to be done before our system, or any system of which I have knowledge, is reliable for intership communication, or before any two

systems can work within the same field without each rendering the other useless, such progress has been made by the Government experimenters that, with no interference by private systems, stations can be successfully operated over at least 150 miles of coast line, and they are now in operation on the North Carolina and Virginia coasts, and soon will be instituted between the Farallone Islands and the mainland, and Tatoosh Island and the mainland, on the Pacific coast.

If a system of selective telegraphy can not be perfected so that one system does not interfere with and render useless another, and thereby prevent all use to commerce of recent discoveries in wireless telegraphy, it may become necessary, on account of the value of these discoveries to our marine interests, for the Government to take exclusive control of all systems of etheric space telegraphy and to establish stations along our extensive coast lines at such distances and in such relation, the one to the other, that they shall not interfere. Even then there will occasionally be difficulty in communicating with the mainland whenever two ships in close proximity are attempting to transmit or receive messages at the same time.

DESTRUCTION OF HAILSTORMS WITH CANNON.

Considerable interest has been aroused among agriculturists in the United States relative to the prevention of hailstorms by the use of explosives fired from specially designed cannon. The experiments conducted along this line by grape growers of France and Italy have aroused popular interest in this country. The theory is not a new one, though perhaps not so ancient as the idea that precipitation occurs soon after and as a result of the explosives used in battles. As early as 1769 the Marquis de Cheviers, a retired naval officer of France, thought that he could combat the scourge of hailstorms by the firing of cannon, but his experiments, like those conducted by many others at various times during the past century, were not productive of definite results.

One of the most serious drawbacks to grape culture in Europe is the destruction caused by hail, and the growers are naturally interested in anything that promises to give immunity from such damage. During the past two or three years renewed interest has been taken in the matter by the vineyardists of certain parts of France and Italy. Several manufacturers have placed upon the market a special form of cannon, which they claim will effectively break up hail-bearing clouds. The belief in the efficacy of this method of protection has become quite general in Europe, although scientists versed in the physics of the air have not expressed confidence in the system.

In brief, the apparatus in use consists of a cannon fitted with a funnel-shaped conical extension. The difference between the various forms of cannon that are used lies mainly in the shape and size of the funnel extensions and the size of the powder charges. Usually the cannon are fired vertically upward, although in some instances the apparatus is inclined toward an advancing cloud. The effect of the funnel attachment is to cause the formation of a mass of rapidly-revolving air, or vortex, which leaves the mouth of the cannon with tremendous velocity. In shape these vortices can be likened somewhat to the rings or puffs of smoke made by a person smoking a cigar. It is claimed that these whirling masses of air, intermixed with gases from the explosives, are forced upward to a sufficient height to enter the hail cloud and destroy its hail-forming processes. If it is granted that these rings ascend to a sufficient height to enter the cloud, I am of the opinion that the force of the ring is too puny to have any appreciable effect on the cloud.

Many experiments have been made for the purpose of ascertaining the actual height to which these air rings rise before being dissipated. In a report by Profs. J. M. Pernter and W. Trabert, who, at the invitation of the Imperial Department of Agriculture of Austria and of the inventor of one of the methods, made as complete an investigation as was possible, and, under various conditions, these scientists stated that they were not able to report anything positive as to the value of hail shooting. They reported that, using the largest cannon and the heaviest charges, the vortices did not ascend to a height of 1,000 feet on an average, although in some instances greater distances were obtained.

There is a marked difference of opinion as to the effectiveness of cannon firing, with the manufacturers and many grape growers on the one side and the scientists of America and Europe on the other. The former maintain that hailstorms can be prevented in the manner described, while the latter claim that the force exerted by the explosives is infinitesimal as compared to the forces of nature that are exerted in hail formation, and that experiments conducted by the adherents of the cannonading process themselves have not produced convincing results. The number of thunderstorms from which hail is precipitated is but a small percentage of the actual number. In most localities of the United States a whole season sometimes passes without a fall of hail, while in seasons of abnormal thunderstorm frequency the number of hailstorms is small. While in the grape-growing regions of France and Italy there may be greater hailstorm frequency, it is still true that the number of hailstorms are few as compared to the number of thunderstorms without hail. The experimenters score a success whenever they shoot at a thunderstorm cloud that does not produce hail, although the chances are greatly in favor of there being no hail in the cloud. Again, they excuse the occurrence of hail in spite of a bombardment by saying that the cannon was not large enough or the powder charge sufficiently heavy, and declare that the hailstorm was far less severe than it would otherwise have been. How is one either to prove or disprove such statements?

It is true that many important discoveries have been made by experiments that were conducted contrary to scientific theories, and in the matter under discussion it is not our intention to overweight the scientist or to underestimate the practical investigator, but unquestioned facts and not explanations must be the proof of results. Scientists both in America and in Europe declare that hailstorms can not be prevented by the use of cannon and explosives of even greater power than have been used or that it is possible for man to use, and they base their belief on such knowledge of the forces of nature as science has revealed. Those opposed attempt to break down the scientists' argument by declaring that no one has yet satisfactorily explained the processes of hail formation. This is true to a certain extent, but enough is known upon which to base a logical opinion.

But there are reasons for believing that the use of cannon and explosives in preventing hailstorms is not effective. Mr. Stiger, one of the inventors of the apparatus in use, claims that hail is formed in quiet spots in the atmosphere, where atmospheric moisture crystalizes out in large crystals in a manner analogous to the formation of large crystals of salt in liquid solution. I agree with Professor Abbe that there are no such quiet spots in the atmosphere, and hailstones are not crystals, but masses of ice with only a partial crystaline structure. Even the perfect crystals of the snowflake are formed in the midst of rapidly moving air. Hailstorms are generally local and very erratic. Some have maintained that they are controlled by the hills or the contour of the ground or by the presence of forests and lakes, and this may be true to a certain degree; but, practically, the whole question is one of ascending and descending currents that characterize whirlwinds and thunderstorms.

Several thousand shooting stations have been established

in Italy and France during the past two years, but reports received from them give no definite data in support of the success of the experiments, although there is no doubt that the cannonading is believed to be effectual by the farmers who do the work. Waves of irrational enthusiasm sometimes sweep over a community, only to be regretted in subsequent years when calmer judgment has come to prevail. We have but to remember the experience of our own country only a few years ago with the rain makers, and how firm was the belief of thousands of people in the subarid and arid regions of the West that the use of powerful explosives would produce rainfall.

Thousands of dollars were expended in these experiments before the absurdity of the claim was demonstrated. It is a fact worthy of remark that the hail shooters are now using practically the same methods to dissipate the clouds that the rain makers used to produce them. Time and experiment will probably demonstrate that hail prevention by such means is as impracticable as rain production. The fact that 15,000 or 20,000 shooting stations have been established is of itself no argument as to the efficiency of the process. One might as well argue that the moon really affects the weather because a million people believe it and can prove it—to their own satisfaction.

A knowledge of the exact truth on any question of natural science is not easily attained. The hail cannonaders base their reports of success upon such statements as "a black cloud was seen approaching, cannon were fired, and the cloud passed over without hail," or "it passed to one side and the hail did not fall on the protected vineyard, and there the hail ceased," or "the cloud broke in two, passing to the right and left, leaving the sky cloudless over the cannon." Now these are quite common cloud and storm phenomena, and they will frequently happen without cannonading. There is no way of telling by the sight of an approaching cloud whether or not is accompanied by hail. Therefore, if the cannon be used every thunderstorm would have to be bombarded, although statistics have demonstrated that only one thunder cloud out of a great number contains hail. In other words, there would be a tremendous waste of time, money, and energy in unnecessary bombardments.

After examining all that has been published during the past two years on the subject of hail prevention, I have to repeat the opinion heretofore expressed that we have here to deal with a popular delusion, and that efforts should be made to prevent its spread in this country. The great processes going on in the atmosphere are conducted on too large a scale for any man or any nation to attempt to control them. According to Professor Abbe, the energy expended by nature in the production of a hailstorm, a tornado, or a rainstorm probably exceeds the combined energy of all the steam engines and explosives in the world. It is useless for man to attempt to combat nature on this scale.

THE MERIT SYSTEM AND THE DISCIPLINE IN THE WEATHER BUREAU.

A system of merit and discipline has been gradually developed in the Bureau, which not only conforms to the letter of the Civil Service law, but carries its spirit to a logical conclusion. The system compels each employee or official to work out his own official salvation. It is fair to all; it enables honest and efficient persons to work themselves upward; it contributes to a high standard of manly character and to efficiency in public office, and it holds back those of mediocre attainments or of slothful habits.

The duties of the Bureau are exacting. It requires a strict discipline to administer a service with such extensive ramifications, and to have every man at his post of duty at exactly the same moment of time. To do this several times each twenty-four hours, as is necessary in the gathering and the charting of simultaneous weather observations, and in the rapid dissemination back to the country of the forecasts and warnings based upon the observations, the observers must be tractable, prompt to respond to orders, which often come by telegraph, and possessed of more than the average of education and intelligence.

The Secretary of Agriculture has given his unqualified approval to existing plans for the gradual intellectual growth and development of the clerks, observers, and other officials of the Weather Bureau.

It has been the purpose of the Chief of the Bureau to recognize only the needs of the Weather Bureau and the merits of its employees in all matters of promotion, reduction, removal, or appointment, and to make only such recommendations to the Secretary as would meet his demands for an efficient service and inspire confidence among the workers of the Bureau in the fairness of the recommendations of the Chief. The Secretary has been liberal in recognizing the meritorious workers of the Bureau; he expects a high standard of fitness in return.

Even before the Executive order requiring that a classified employee be given opportunity to answer charges before removal, no employee of the Weather Bureau was removed without a full investigation of his offense, and in no case was removal made of a person properly performing his duties. No person shown to be incompetent or unfit for the public service has been retained in the Bureau; and, except in one case where removal was made without the knowledge that the employee had not been given the opportunity to retrieve himself that the Chief had directed, no person removed for either inefficiency or bad conduct has been reinstated.

It should not be supposed that promotion can be gained simply by passing the educational test. On the contrary, an employee must (1) make a good record for aptitude, efficiency, industry, and manly character, and (2) pass the educational test considered necessary to qualify him for the duties of the next higher grade.

Efficiency is determined from the observation of the work of the employee by his immediate official superiors, and by the general appearance and the accuracy of such of the employee's work as may come under review at the central office in Washington.

Character is determined by the personal opinion of the employee's official superiors with regard to his general behavior as an officer, his social affiliations, his neatness of dress, his integrity of character, and his observances of the courtesies of business life.

Educational qualifications are determined by examination in the following subjects: English grammar, practical arithmetic, algebra (through quadratics or equations of the second degree), plane elementary trigonometry, elementary physics, popular astronomy, elementary plant physiology, and meteorology.

The educational qualifications for promotion are apportioned as follows:

For promotion to grade of $1,000 or more per annum—English grammar, practical arithmetic, and elementary meteorology.

For promotion to grade of $1,200 or more per annum—Elements of algebra through quadratics, elements of plane trigonometry, and elementary physics.

For promotion to grade of $1,400 or more per annum—Popular astronomy, elementary plant physiology, and meteorology.

A proficiency of 70, on a scale of 100 as perfect, is required to pass each of the subjects.

The foregoing examinations are not obligatory, and failure

to take them will not of itself be made the cause of reduction. Failure to take these examinations, and thereby to become qualified for promotion, will be construed simply as an evidence of satisfaction with the grade held at the time and a tacit indication of no desire for advancement.

In order that a high standard of official integrity and manly character may obtain throughout the various branches of the Weather Bureau, it is required that a firm yet kind discipline be maintained by all officials in charge of stations. For the preservation of the peace of their offices and the efficiency of the public service, they are enjoined not to permit one subordinate secretly to impeach the integrity of another, or to carry tales about his companions. Every complaint must be stated either in the presence of the one against whom it is directed, or else in writing and be referred to him for answer, so that no unjust impression may find lodgment in the mind of a supervising officer.

The new appointee is selected from a list of eligibles certified by the United States Civil Service Commission. He can not be certified until he has passed an examination by the Commission in spelling, arithmetic, penmanship, copying from rough draft, meteorology, English composition, geography, and algebra; nor if he be under 18 or over 30 years of age. The applicant is appointed for a probationary period of six months. In each case the appointee is informed in writing and required to acknowledge the receipt of the communication, to the effect that the policy of the Bureau, under the direction of the Department, is to recommend for absolute appointment only those persons who show complete fitness for the work of the Bureau, and he is especially cautioned that no consideration except his own worth and value to the service will have any weight whatever in determining the matter of his retention.

Experience has demonstrated the wisdom of thus impressing upon a young man's mind the idea that, beginning with the very first day of his connection with the Bureau, he stands upon his own merit. It induces him to take up his work with a purpose and determination to earn, and therefore attain, permanency of position, with results generally gratifying to him and beneficial to the public service.

Once a month throughout the probationary period the official under whose immediate supervision the employee is placed renders a report on the conduct, service, and progress of the probationer, and this official is held strictly responsible that the reports be full and impartial. If after the trial period it is clearly shown that the appointee is morally, mentally, and physically qualified, permanent appointment is made. While the rules laid down for the guidance of probationers are exacting, yet it is required that they be applied with the utmost fairness, and when early reports indicate that the prescribed standard has not been maintained, admonition is sent at once to the employee when time remains for improvement; but undesirable employees are not retained after the expiration of six months, even on the ground sometimes put forth that they may qualify if given more time to develop.

The efficiency of the service can only be maintained by a rigid system of selection, and only those fully fitted to meet the exacting requirements of the Weather Bureau receive recommendation for permanent appointment.

As an illustration of the results that may be expected to follow after a just system of promotion has been inaugurated in a Government bureau, and adhered to for several years, I point to the fact that although it was known to every person in the Weather Bureau that Congress had made provision in the present appropriation bill for an additional professor, at $3,000 per year, and for two forecast officials, at $2,000 each, several months before the actual appointments were made, not a single employee made application for or exerted influence to secure one of these desirable places or any of the many promotions that resulted from these appointments. I am confident that the employees of this service realized that the persons best fitted for these important offices would be selected and that personal application was unnecessary.

Such a discipline has proved its beneficence during six years of practise. It has the hearty good will of the employees of the Bureau, and the Secretary of Agriculture and the appropriations committees in Congress have sustained the Chief of Bureau in its enforcement.

STORM-WARNING TOWERS.

Sixty of the new storm-warning towers referred to in my last annual report were installed during the past year, and each was equipped with improved lanterns. In the majority of cases electricity is used as the illuminant. As a result of these improvements the distribution of storm warnings to shipping interests along the seacoasts and on the Great Lakes has been made much more effective. The work of placing these towers and lanterns at all the storm-warning display stations of the service will be prosecuted as fast as available funds will permit, and it is expected that 60 additional stations will be equipped by January 1, 1902.

WEATHER STUDIES IN SCHOOLS.

The increasing attention given to the subject of meteorology in schools and colleges throughout the country has resulted in large demands upon the officials of the Weather Bureau for lectures and other forms of instruction on this subject. Officials of this service have cooperated with educational institutions in this work as far as their official duties would permit.

BAROMETRIC REDUCTIONS.

The revision of the barometric system for the United States, Canada, and the West Indies is practically complete, and the results will soon be published. This work was conducted by Prof. F. H. Bigelow, and included a reexamination of the various elevations, the local and instrumental errors, the reduction of the station pressures to a homogeneous system, and the preparation of normal tables and charts of pressure, temperature, and vapor pressure at sea level, and at the 3,500-foot and 10,000-foot planes.